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(54) IMPROVEMENTS RELATING TO THE REGULATION OF THE OUTPUT OF FLUID COUPLINGS

(71) We, DAIMLER-BENZ AKTIENGESELLSCHAFT, of Stuttgart-Unterturkheim, Germany, a Company organised under the laws of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns improvements relating to the regulation of the output speed of fluid couplings by control of the filling, especially but not exclusively the regulation of fan drives for internal combustion engines, particularly motor vehicles, of the kind having a reservoir connected to the working chamber and containing non-rotating drain tubes, whose effective diameter can be adjusted, which serve to return the coupling fluid to the working chamber.

In known couplings of this kind, the drain tubes are generally rockable so that the diameter at which their mouths are located can be varied. In this way, the proportion of fluid present in the working chamber and hence the slip of the coupling can be regulated. The tubes have to be movable, by a motion-transmitting element, in both directions. For greater slip the effective diameter has to be reduced (rocking in one direction) and, for less slip, the effective diameter has to be increased (rocking in the other direction).

For some regulating arrangements, however, it is often a requirement that it should be possible to produce a reverse effect, with respect to filling of the coupling, for the same movement of the transmitting element. This problem exists, for example, with the above-mentioned fan drives, which are normally controlled in dependence on temperature, if the transmitting system fails due to some defect. It is then required that the coupling should "fail safe", i.e. become engaged to ensure that the fan is driven. The present invention seeks particularly to provide a solution of this problem.

[*Price 5s. 0d. (25p)*]

According to the invention, a fluid coupling having means for regulating its output speed by control of the filling of the working chamber, comprises a reservoir connected to the said chamber and containing at least two angularly offset non-rotating drain tubes which serve to return the fluid to the said chamber, the said tubes being disposed on a common support by means of which, under the control of a transmitting element, they can be moved, in a plane at right angles to the axis of the coupling and at least approximately rectilinearly or curvilinearly, so that their mouths are displaced in opposite directions in relation to the fluid in the said chamber, i.e. one towards and one away from the free surface of the fluids, for the purpose of adjusting the effective diameter at which the said mouths act. The coupling itself may take the form of a hydrodynamic or viscous-fluid coupling.

With the arrangement according to the invention, under normal conditions of operation, the filling of the coupling, and hence its slip, can be controlled, by the transmitting element, through one drain tube in the usual manner. If, however, the transmitting element should break down, or the transmission system between it and a thermostat should develop a leak, the transmitting element can be moved by spring means, of by inherent elasticity, in the direction corresponding to falling temperature and thus the other drain tube brought into action, which returns fluid to the working chamber and causes the coupling to be engaged. With the above-mentioned fan drive, it is thus possible to prevent overheating of the engine.

In a preferred embodiment of the invention, there are two drain tubes offset by 180° in relation to each other. However, some other angle, e.g. 90° or 120°, could be chosen. The direction of movement of the support may be the longitudinal direction of one or both of the drain tubes or at equal angles to both tubes. The mouths of the drain

tubes may each be directed oppositely to the direction of rotation of the coupling.

Generally, drain tubes of equal length will be used. However, the tubes may be of different lengths. The middle position of the tube support may correspond to minimum filling of the coupling. It may then be arranged for the coupling to remain disengaged, or run with only low slip, over a required temperature range.

The common tube support may consist of a tongue which extends, from the tubes, axially through the housing of the coupling and is acted upon, outside the housing, by the transmitting element on the one hand and by spring means on the other.

In the above-mentioned preferred embodiment of the invention, the transmitting element may consist of an expansible bellows which is connected to a thermostat, suitably by a capillary tube, and is disposed in a housing, the tube-supporting tongue being connected to the bellows by a rod which is slidably guided in that housing. The transmitting system may be filled with fluid. If the fluid is a vaporizable liquid, a broken or markedly progressive speed/temperature characteristic is obtained.

In one form of embodiment the rod passes through the tube-supporting tongue and is connected to a prestressed leaf spring, which then supplies a restoring force. In another form of embodiment, the said tongue is disposed between the rod and a coil spring axially aligned with the rod and with its far end bearing against the housing or other fixed abutment.

Ways of carrying the invention into effect will now be more fully described with reference to the accompanying drawing, in which:—

Figure 1 is a diagrammatic axial section through a viscous-fluid coupling,

Figure 2 is a diagrammatic transverse section showing the drain tubes of the coupling of Figure 1,

Figure 3 is a diagram showing the characteristic of this coupling, and

Figures 4 and 5 are axial sections illustrating two forms of transmitting element.

In the example illustrated, the housing 10 (Figure 1), which forms the driving part of the coupling, is combined with a V-belt pulley 11, through which it is driven from the crankshaft of an air-cooled internal combustion engine. The disc-shaped driven part 12a of the coupling is fast on a shaft 12 on which the fan 13 of the engine is mounted. The coupling has a working chamber 14 and a reservoir 15 divided from each other by the part 12a but communicating with each other through openings 16 in the said part. The fluid flows from the chamber 14 into the reservoir 15 through the openings 16. Mounted in the reservoir 15, on a supporting tongue 17, are two drain tubes 18 (Figure 2) which have a common connection 19 leading into the chamber 14.

As shown in Figure 2, the tubes 18 are offset by 180° in relation to each other. They are equal in length and their mouths 20 are directed oppositely to the direction of rotation of the coupling. In the position illustrated, neither of the two tubes penetrates into the ring 21 of fluid and the coupling is substantially disengaged.

By the tongue 17, the two drain tubes 18 can be moved rectilinearly, in a plane at right angles to the axis of the coupling, to the right and to the left from the mid-position illustrated in Figure 2. This movement is produced by a transmitting element to be described. Upon the movement of the support 17 to the right or to the left, one or other of the tubes 18 will dip into the fluid at 21 and drain fluid from the latter back into the working chamber 14. The coupling then becomes filled to a greater or less extent, the slip becomes less and, in other words, the coupling is engaged. In this way, a regulation characteristic can be produced such as is shown in Figure 3, in which fan speed s is plotted against displacement d of the tubes 18 in the one (+) or the other (—) direction from the mid-position o. In either case, the fan speed rises to its maximum value.

A supporting part, e.g. a plate, has fixed on it a stationary housing 22 (Figure 4) which encloses an expansible bellows 23 serving as motion-transmitting element. The bellows 23 is connected by a capillary tube 24 to a thermostat (not shown) which may be located, for example, on the cylinder head of the engine. Connected to the bellows 23 is a rod or plunger 25 slidably guided in the housing 22. The tongue 17 supporting the drain tubes 18 is fixed on the rod 25. The rod 25 is loaded by a prestressed leaf spring 26 which is mounted on a stationary part, for example the aforesaid plate. The spring provides the restoring force for the bellows 23.

With increasing temperature at the thermostat, the bellows 23 will expand and push the rod 25, and with it the tongue 17 and drain tubes 18, to the left against the resistance of the spring 26, causing the coupling to be engaged, as already described. If a leak develops in the tube 24 or at some other point in the transmitting system, the spring 26 will push the tongue 17 from the mid-position, or from the position determined by the temperature at the time, fully to the right, as far as permitted by a stop, so that the coupling will also be engaged in that event.

In Figure 5, the tongue 17 supporting the drain tubes is situated between the rod 25 of the bellows 23 and one end of a coil spring 27 whose other end bears against a fixed

abutment. In principle, the manner of operation of this arrangement is the same as that described for Figure 4.

If desired, there may be more than two drain tubes angularly offset in relation to each other. Instead of being rectilinear, the displacement imparted to the tubes may be curvilinear, for example along a slightly arcuate path. The tubes need not be of the same length, but may be different lengths.

WHAT WE CLAIM IS:—

1. A fluid coupling having means for regulating its output speed by control of the filling of the working chamber, comprising a reservoir connected to the said chamber and containing at least two angularly offset non-rotating drain tubes which serve to return the fluid to the said chamber, the said tubes being disposed on a common support by means of which, under the control of a transmitting element, they can be moved, in a plane at right angles to the axis of the coupling and at least approximately rectilinealy or curvilinearly, so that their mouths are displaced in opposite directions in relation to the fluid in the said chamber for the purpose of adjusting the effective diameter at which the said mouths act.

2. A coupling as claimed in claim 1, wherein there are two drain tubes offset by 180° in relation to each other.

3. A coupling as claimed in claim 1 or 2, wherein the tubes are of different lengths.

4. A coupling as claimed in any one of claims 1 to 3, wherein the common support consists of a tongue which extends from the tubes axially through the housing of the coupling and is acted upon outside the housing on the one hand by the transmitting element and on the outer by spring means.

5. A coupling as claimed in claim 4, wherein the transmitting element consists of an expansible bellows which is connected to a thermostat and is disposed in a housing, the tongue being connected to the said bellows by a rod slidably guided in the bellows housing.

6. A coupling as claimed in claim 5, wherein the rod passes through the tongue and is connected to a prestressed leaf spring.

7. A coupling as claimed in claim 5, wherein the tongue is disposed between the rod and a coil spring axially aligned therewith and having a fixed abutment at its far end.

8. A fluid coupling substantially as hereinbefore described with reference to Figures 1 to 3 and to Figure 4 or Figure 5 of the accompanying drawing.

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1213075 COMPLETE SPECIFICATION

1 SHEET This drawing is a reproduction of the Original on a reduced scale

Fig.1

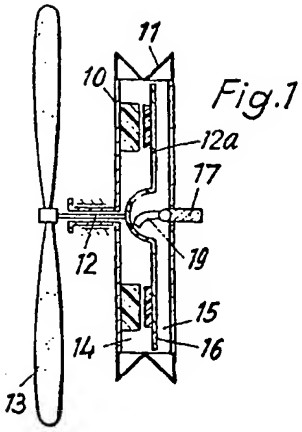


Fig.2

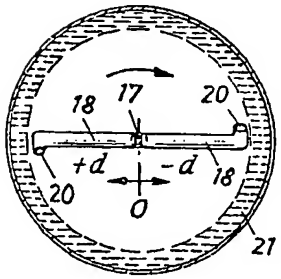


Fig.3

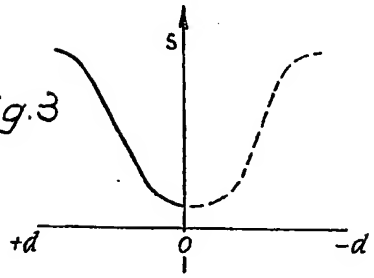


Fig.4

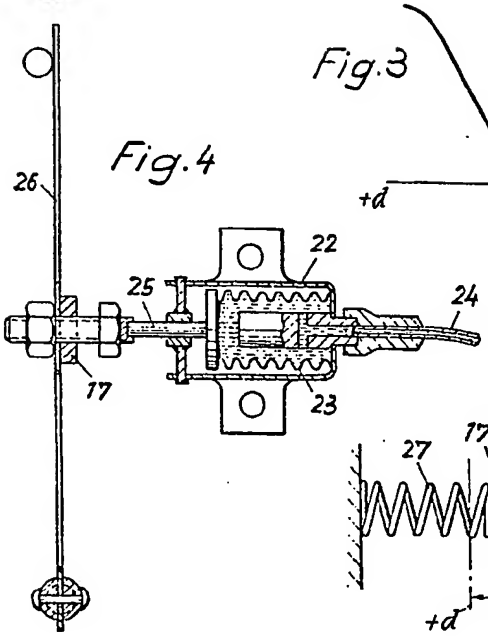
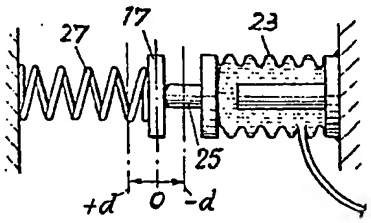


Fig.5



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 04 25 4177

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	GB 1 213 075 A (DAIMLER-BENZ AG) 18 November 1970 (1970-11-18) * page 1, line 17 - page 1, line 20; figures 1,2 *	1,5,9, 11-15, 21,24,25	F16D35/02 F01P7/04
Y	* figures *	4	
X	US 3 458 020 A (LUTZ OTTO) 29 July 1969 (1969-07-29) * figure 3 *	1,5,9, 11-14, 21,22, 24,25	
Y	* figures 1,2 *	4	
X	US 3 688 884 A (PERRIN GUNTER ET AL) 5 September 1972 (1972-09-05) * figures *	1,5, 9-14,21, 22,24,25	
Y	* figure 1 *	4	
Y	US 3 559 786 A (LONG PAUL J JR) 2 February 1971 (1971-02-02) * column 1, line 72 - column 2, line 5; figures *	4	TECHNICAL FIELDS SEARCHED (Int.Cl.7) F16D F01P

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 November 2004	Junk, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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